Case Study	**Consolidated Papers Inc.** **Chlorine Reduction in Kraft Bleaching Process**
Standard Industrial Classification (SIC)	Paper/2600 and Printing/2700
Type of Waste	Dioxin as a byproduct of chlorine pulp-bleaching process
Strategy	Process modifications and material substitutions
Company Background	Consolidated Papers, Inc. produces coated and supercalendered printing papers, kraft pulp from virgin wood fiber and recycled pulp from post-consumer office wastepaper. They also manufacture lightweight coated specialty papers for product packaging and labeling. Other products manufactured by the company include paperboard, paperboard products and standard and custom-designed corrugated displays and containers. Consolidated is headquartered in Wisconsin Rapids, employs approximately 6,000 people and operates manufacturing facilities in central Wisconsin; Niagara, Wisconsin; and Duluth, Minnesota.
Original Process	Pulp is bleached to remove colored materials from the wood fibers and produce a pulp white enough for subsequent use. Like most kraft pulp mills, Consolidated's Kraft Division was originally designed to use chlorine in the first step of the bleaching process. That chlorine reacted with the residual lignin in the pulp and produced a variety of chlorinated organic substances. Most of these chlorinated substances were disposed of along with the bleach plant wastewater. Some of the more volatile substances were also emitted to the air. Both the wastewater and the air emissions were treated prior to release. The wastewater was treated in a company-owned and operated wastewater treatment plant. The bleach plant air emissions were treated in a scrubber with a caustic (alkaline) scrubbing media to remove chlorine and other pollutants.
Motivation	When the use of elemental chlorine in the pulp-bleaching process was linked to the creation of dioxin (2,3,7,8-TCDD), Consolidated Papers took aggressive steps to reduce the use of elemental chlorine in the kraft pulp-bleaching process. The company's goals were to virtually eliminate the generation of dioxin and significantly reduce the formation and release of chloroform and other chlorinated organic compounds by implementing a multi phase plan.
Pollution Prevention Process	Two techniques are in use to reduce chlorine; improved processes to remove as much lignin and other colored materials from the pulp; and material substitution for chlorine in the bleach plant. • **Phase I:** High chlorine dioxide substitution in the first stage of bleaching and the use of hydrogen peroxide with oxygen in the lignin-extraction stage for the hardwood and softwood lines. Improved hardwood brownstock washing, prior to bleaching. • **Phase II:** Installation of softwood oxygen delignification and

	associated brownstock washing. Consolidated has been using oxygen delignification in the hardwood process since 1986. • **Phase III:** Installation of equipment to completely replace elemental chlorine. This new elemental chlorine-free (ECF) pulp-bleaching process will utilize high-consistency ozone on hardwood and chlorine dioxide on softwood to replace elemental chlorine in the first stage of bleaching. This is a relatively new technology with consolidated having the second installation in North America and fourth in the world. This application is the first to be used internationally on hard wood on a continuous basis.
Material/Energy Balance	• **Wastewater** The wastewater from the bleach plant is still treated in the wastewater treatment plant but now contains less chlorinated organic substances. Dioxin is not detectable in the wastewater from the Kraft Division or in the pulp produced by the division. • **Biosolids** The wastewater treatment biosolids from the wastewater treatment plant also do not contain detectable dioxin levels. This makes the biosolids more suitable for beneficial landspreading on agricultural lands, which is the current disposal mechanism. The biosolids were previously landfilled. • **Air Emissions** Air emissions from the bleach plant are treated by two high efficiency wet scrubbing systems prior to release. Chloroform emissions from the bleach plant have been reduced by 86% and chlorine emissions have been reduced by 97%.
Stage of Development	Phase I was completed in 1992, Phase II was completed in 1993 and Phase III is expected to start up in late 1996.
Economics	**Capital Costs** $35 million (Phases I and II) +$33 million (Phase III) $68 million Total **Payback Period** This program saves approximately $500,000 per year in avoided landfill costs and extends the landfill life by approximately 20 years. Other financial benefits include reduced wastewater and air emission treatment and disposal costs and avoided capital expenditures for wastewater and air emission control equipment.
Benefits	The significant results are: nondetectable levels of dioxin in the pulp, treated wastewater effluent, and wastewater treatment biosolids; substantial reduction in the emission of chlorinated organic compounds; and a significant decrease in the formation and emission of chloroform.
Obstacles	The cost of the project was high with little increase in productivity.

	Many pulp mills are completing similar projects at this time which complicated equipment delivery schedules. In Wisconsin, pollution prevention equipment is not provided the same preferential tax treatment as pollution control equipment.
Other Waste Reduction Activities	• **Internal Environmental Compliance Incentives Program:** Consolidated has established internal wastewater standards for the quantity of flow, BOD (biological oxygen demand) and suspended solids produced by each of its manufacturing plants. These standards include significant financial penalties if they are exceeded, as well as monetary awards (incentives) if wastewater discharges are low. • **Spill Prevention and Control Program:** Each of Consolidated's manufacturing facilities have evaluated their potential for spills (unpermitted releases of any kind to the environment) and have implemented steps to reduce spills to the extent practical.
Technology Transfer	This equipment is commercially available.
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Pollution Prevention Resources	**Free, On-site Technical Assistance** University of Wisconsin Extension Solid and Hazardous Waste Education Center Milwaukee area: 414/475-2845 Remainder of state: 608/262-0385 **Pollution Prevention Information Clearinghouse** Wisconsin Department of Natural Resources Cooperative Environmental Assistance 608/267-9700 or e-mail: cea@dnr.state.wi.us

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